

ROADSHOW #2
**Tunnels in Germany &
challenges towards Automated Driving**

Hi-Drive Webinar 02 – 22.09.2023

Anne Lehan | Federal Highway Research Institute (BASt)



AGENDA

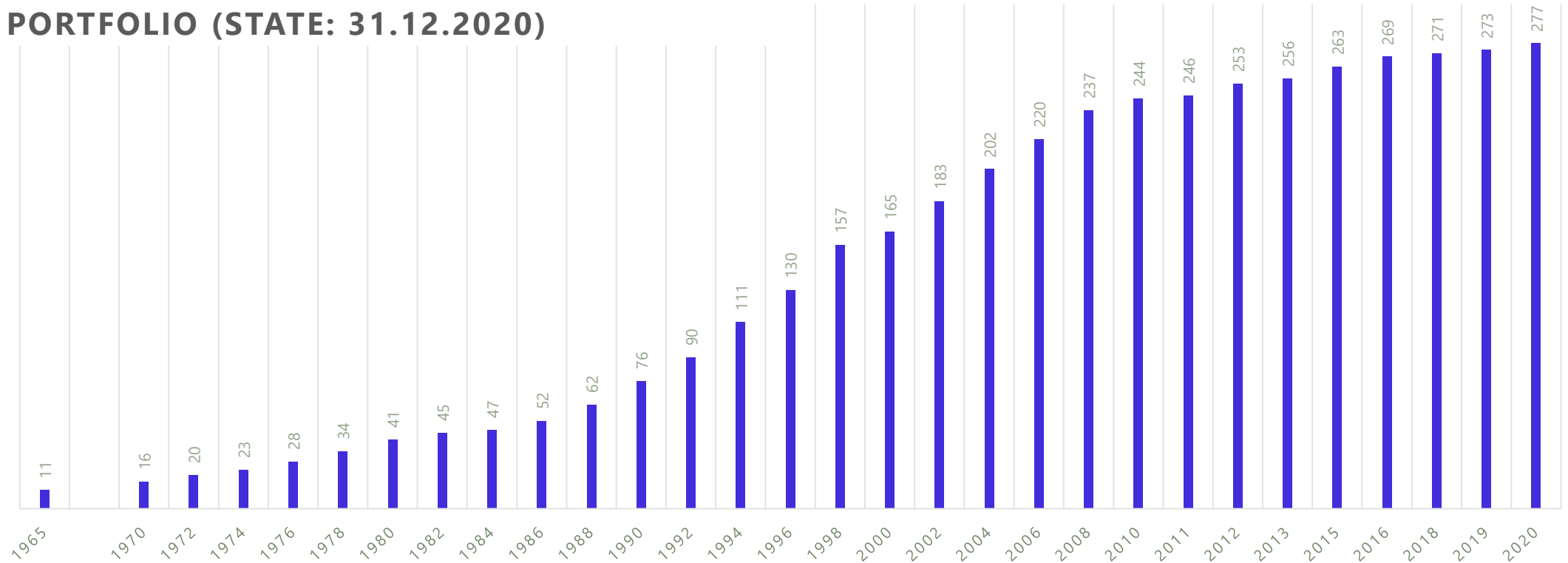
1. Facts & Figures
2. Regulations and Standards
3. Tunnel Equipment
4. Events
5. Outstanding Questions
6. Tunnel Rennsteig

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FACTS & FIGURES

FACTS & FIGURES

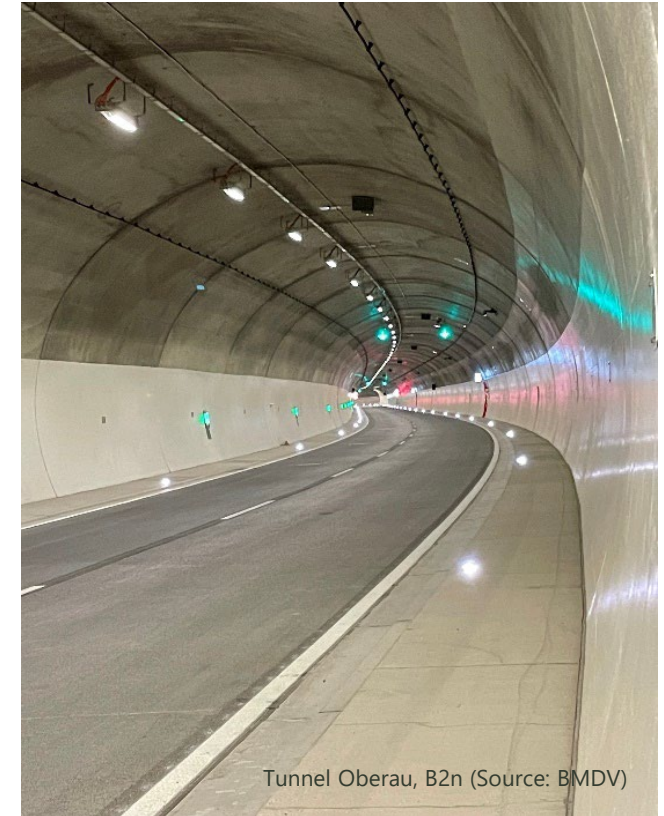
FEDERAL TRUNK ROAD TUNNELS IN GERMANY PORTFOLIO (STATE: 31.12.2020)



FACTS & FIGURES

Directional traffic tunnels

Tunnel name	Road	Status	Construction obligation	Tube length [m]	Clear width per Tube [m]
Rennsteigtunnel	A 71	In operation	FG [Federal Government]	7916 und 7878	9,50
Tunnel Hirschhagen	A 44	In operation	FG	4147 und 4204	9,50
Tunnel Königshainer Berge	A 4	In operation	FG	3300 und 330	9,50
Elbtunnel 4. Röhre	A 7	In operation	FG	3100	10,63
Jagdbergtunnel	A 4	In operation	FG	3074 und 3070	13,00
Tunnel Oberau	B 2 n	In operation	FG	2971 und 2910	9,50
Tunnel Berg Bock	A 71	In operation	FG	2730 und 2730	9,50

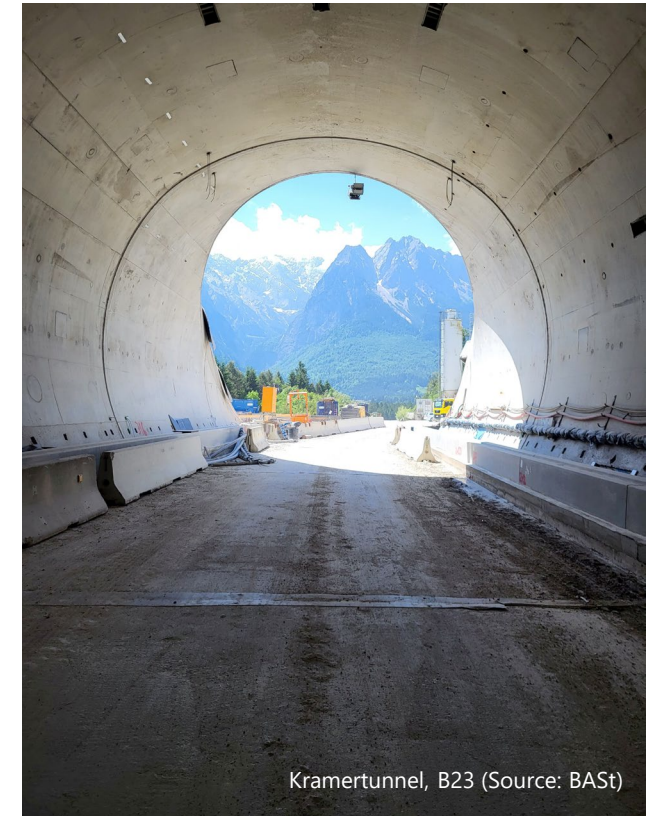


Tunnel Oberau, B2n (Source: BMDV)

FACTS & FIGURES

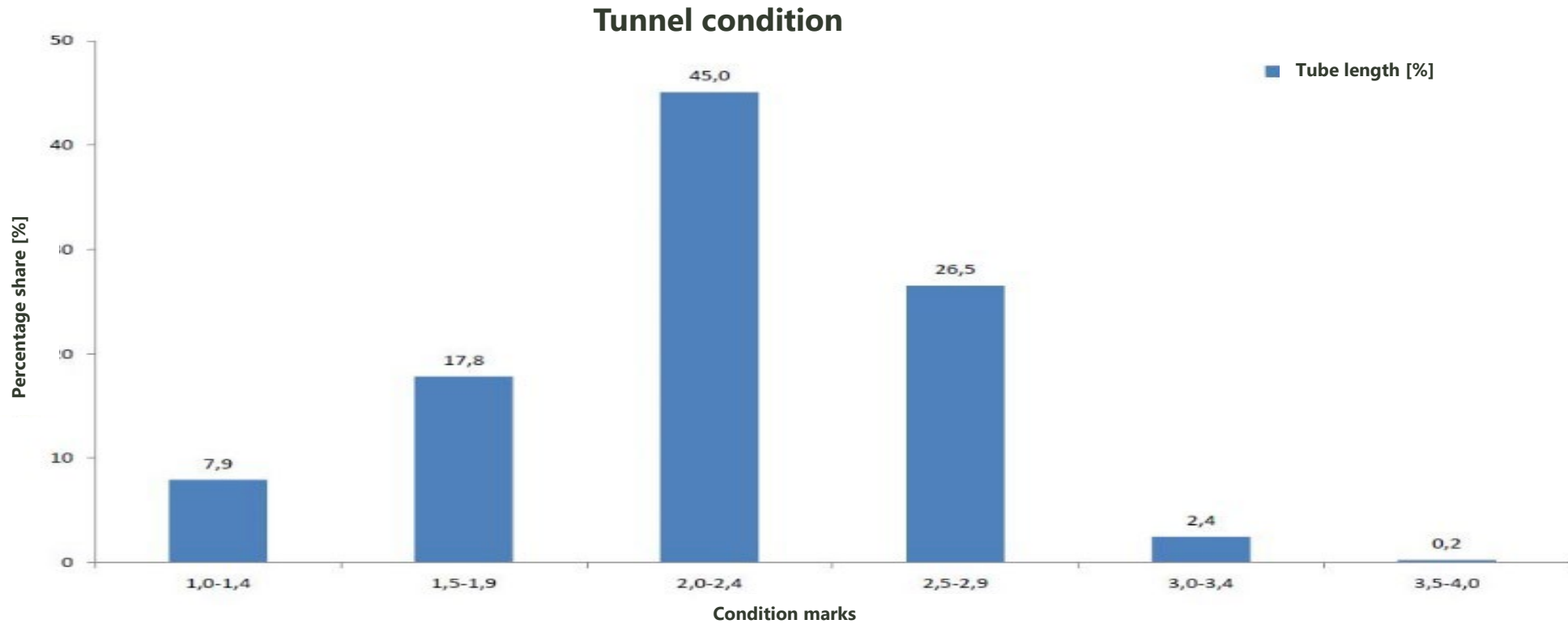
Bi-directional traffic tunnels

Tunnel name	Road	Status	Construction obligation	Tube length [m]	Clear width per Tube [m]
Kramertunnel	B 23	Under construction	FG	3604	9,50
Saukopftunnel Weinheim	B 38 A	In operation	FG	2715	9,50
Michaelstunnel Baden-Baden	B 500	In operation	FG	2700	9,50
Stuttgart Heschlach	B14	In operation	City	2300	9,50
Wattkopftunnel Ettlingen	L 562	In operation	Federal State	1950	9,50
Hornbergtunnel	B 33	In operation	FG	1884	10,50



FACTS & FIGURES

Condition



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REGULATIONS & STANDARDS

REGULATIONS & STANDARDS

Tunnel Safety/ Background

After fire accidents in Alpine countries, safety requirements for road tunnels were reviewed.

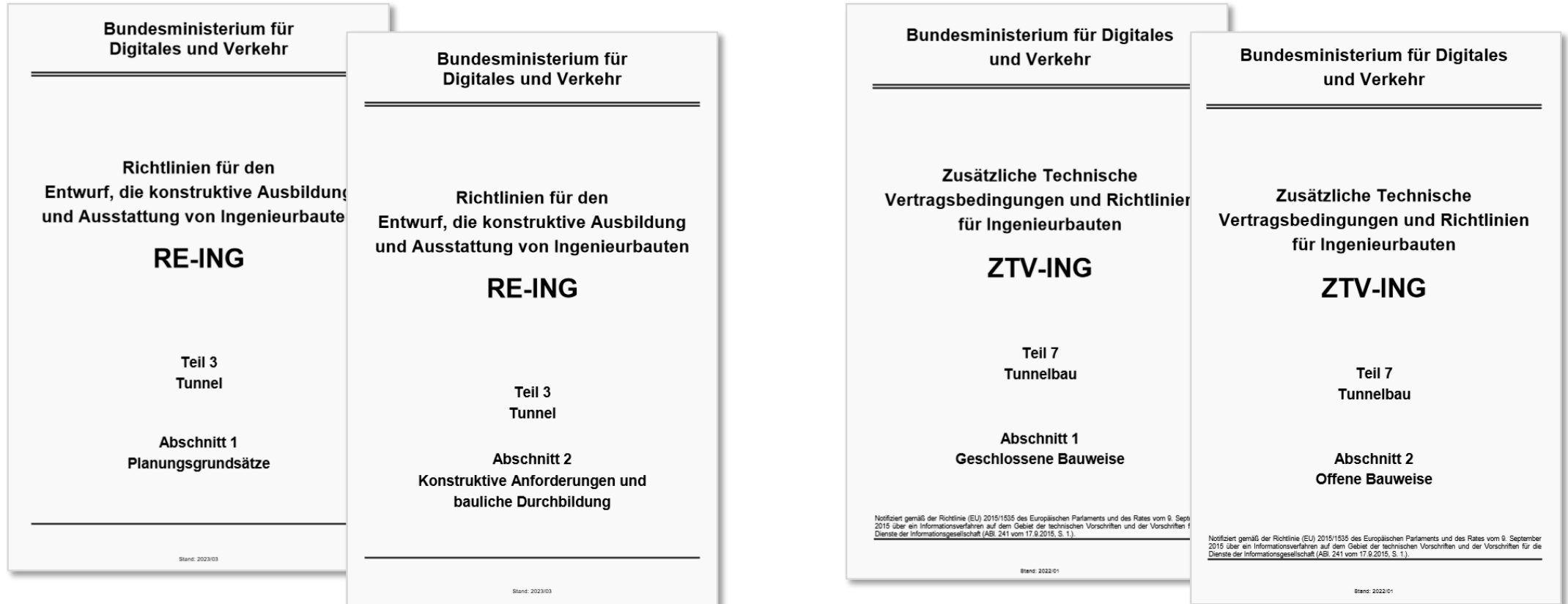
Focus: Improving the self-rescue of tunnel users

- Extensive safety retrofit program
- New safety measures in compliance with the European Tunnel Safety Directive
- German road tunnels have a very high safety level



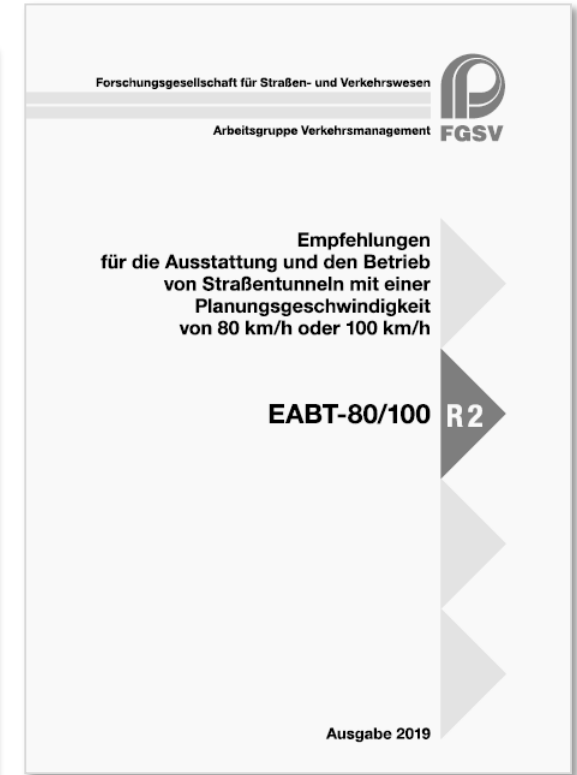
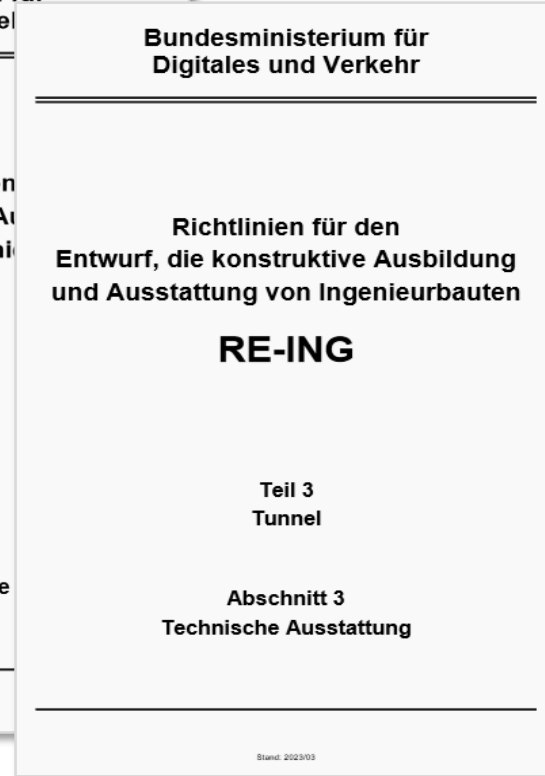
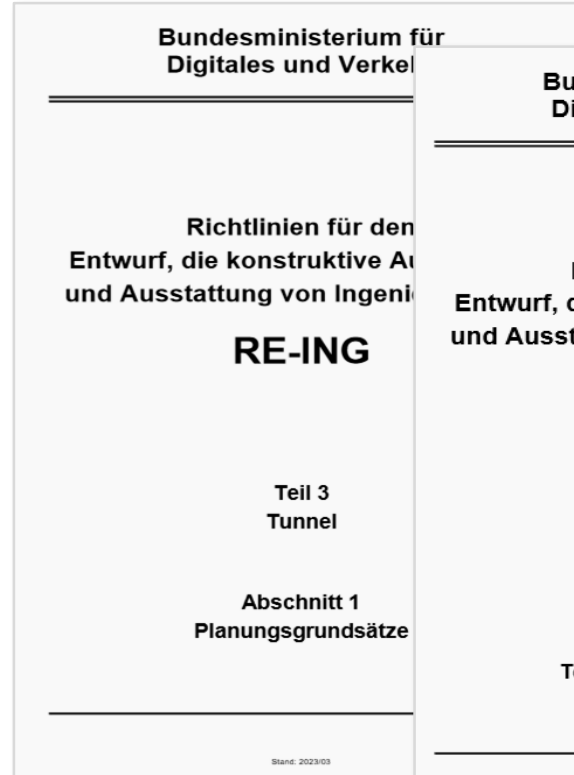
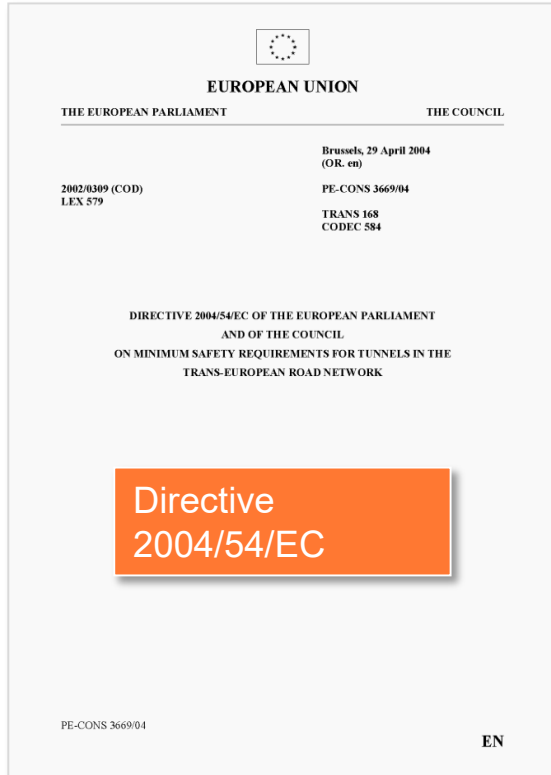
REGULATIONS & STANDARDS

Tunnel design and construction



Regulations & standards

Tunnel Equipment



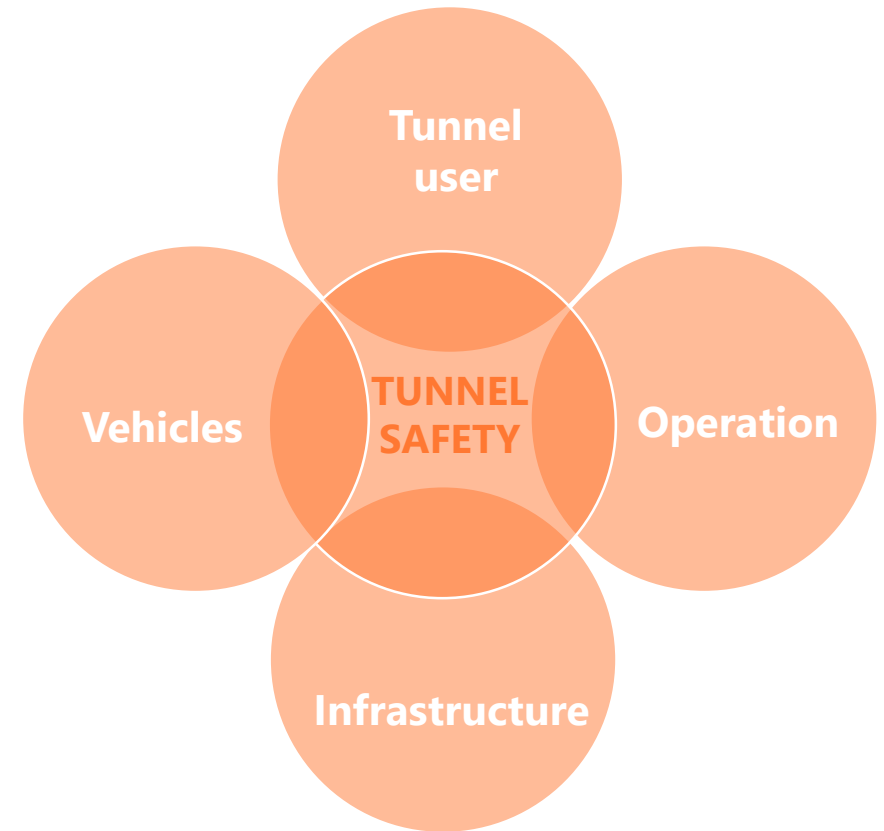
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TUNNEL EQUIPMENT

WHAT MAKES TUNNEL SO SPECIAL?

Tunnel Equipment

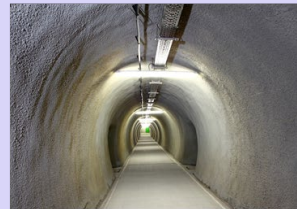
- **High requirements for safety and availability**
- The **consequences** of events are significantly higher than on open road
- High level of **technical equipment**
- High effort in **maintenance** and **repair**
- High **operating** and **maintenance costs**
- High **energy demand**



TUNNEL EQUIPMENT

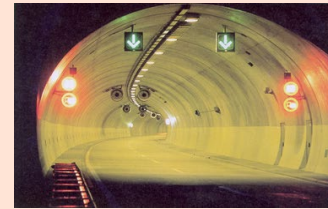
STRUCTURAL EQUIPMENT ELEMENTS

- Side stripes
- Emergency and breakdown bays
- Emergency walkways
- Emergency exits
- Escape routes and rescue tunnels



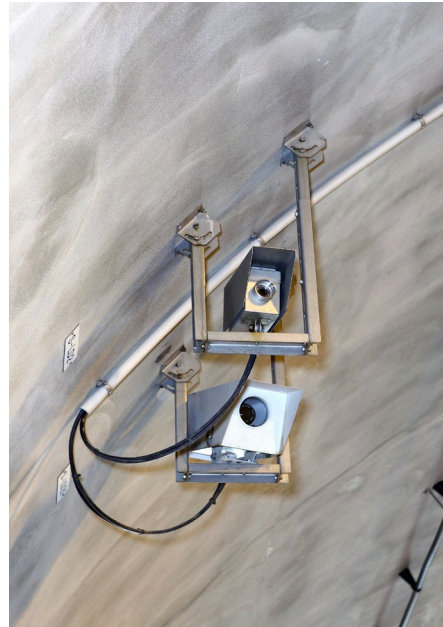
TECHNICAL TUNNEL EQUIPMENT

- Lighting
- Ventilation
- Communication Equipment
- Fire detection and extinguishing equipment
- Escape route marking and emergency fire lighting



TECHNICAL TUNNEL EQUIPMENT

Communication/ Video surveillance



Tunnel Control Center

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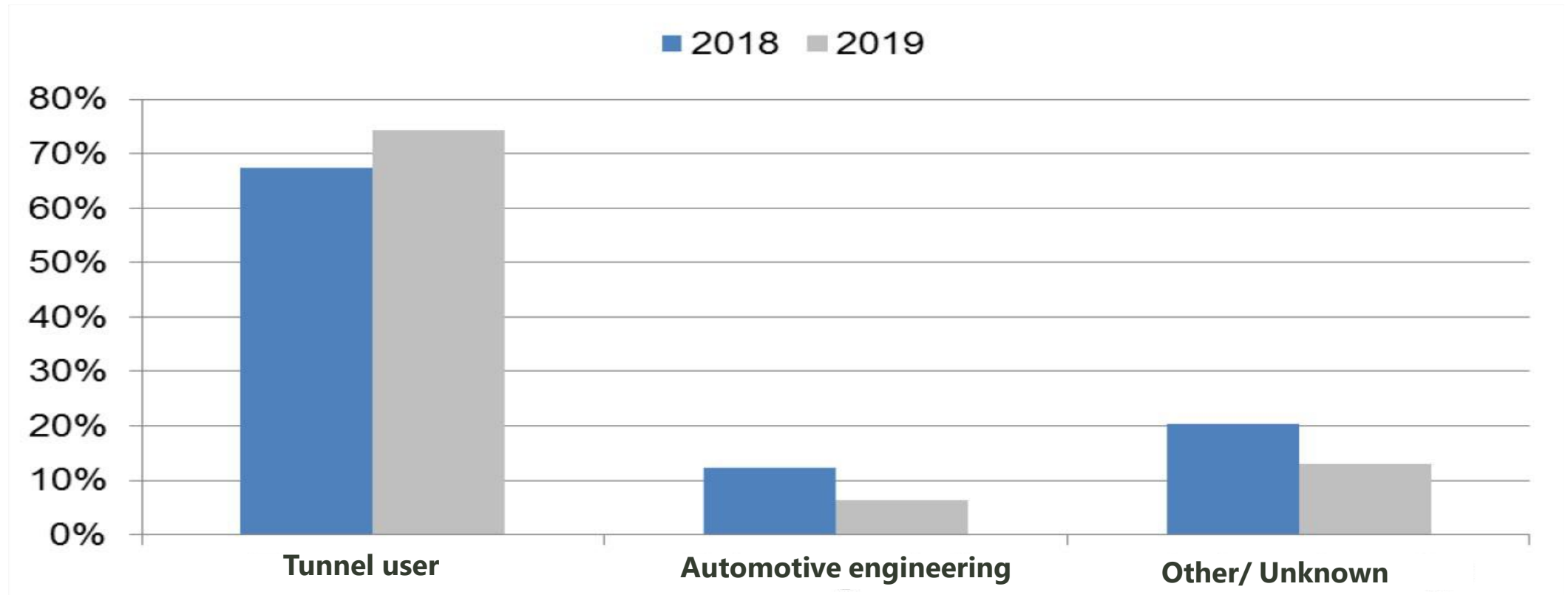
Tunnels > 400 m

3

EVENTS

EVENTS

Percentage distribution by cause of event

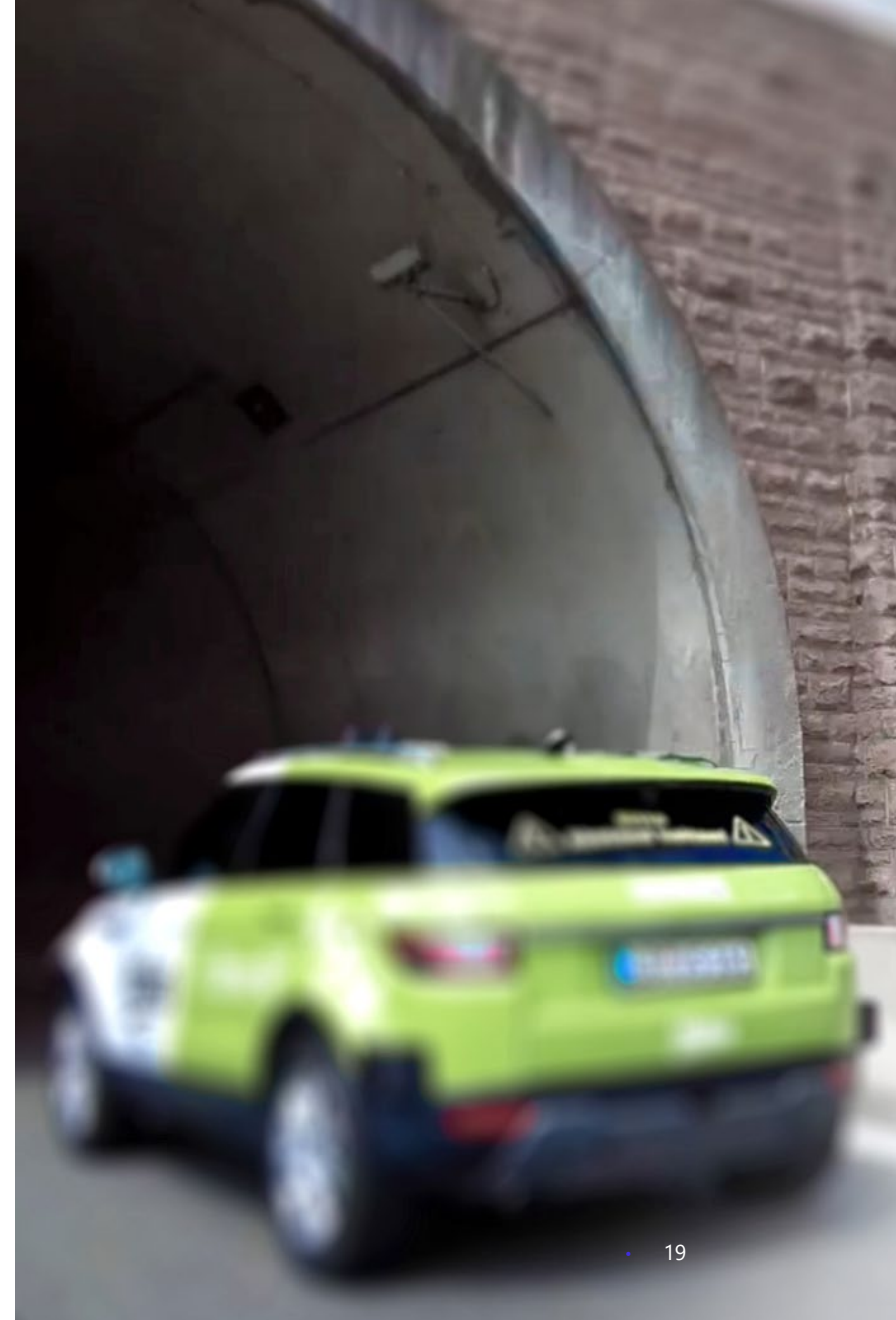


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OUTSTANDING QUESTIONS ON REQUIREMENTS FOR
AUTOMATED DRIVING IN TUNNELS

Outstanding Questions on Requirements for Automated Driving in Tunnels

- Technology Geo-localisation/ Missing contact of satellites
- Rapid Change of environment (tunnel entrance/exit)
- Evaluation of available products
- Responsibility of provision for necessary infrastructure
- Additional technical equipment is mandatory
- Adaption of operating procedures in normal or event situations
- Voting of procedures and instructions for action in the transmission phase of mixed traffic



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TUNNEL RENNSTEIG

RENNSTEIG TUNNEL

Facts & Figures



- Inauguration: **July 2003**
- Cost: **200 Mio €**
- Cost technical equipment: **50 Mio. €**
- Tunnel length
 - East tube: **7.878 m**
 - West tube: **7.916 m**
- North and south portal: **600m**
- max. point in the center (lay-bay 7): **670m**



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THANK YOU FOR
YOUR KIND ATTENTION.

Anne Lehan

Federal Highway Research Institute (BASt)

lehan@bast.de

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